

# MIL-W-81381/21A(AS)

5 October 1977

SUPERSEDING

MIL-W-81381/21(AS)

17 March 1977

## MILITARY SPECIFICATION SHEET

WIRE, ELECTRIC, FLUOROCARBON/POLYIMIDE INSULATED, LIGHT WEIGHT,  
TIN COATED COPPER CONDUCTOR, 600 VOLTS, 150°C,  
NOMINAL 5.8 MIL WALL

This specification sheet is approved for use by the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

The complete requirements for procuring the wire described herein shall consist of this document and the issue in effect of Specification MIL-W-81381.

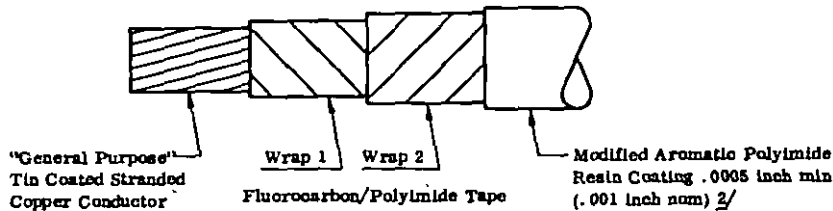


TABLE 1. Construction details.

Part Number 1/	Wire Size	Conductor			Finished Wire				Insulation Tapes			
		Stranding (Number of Strands X AWG gage of strands)	Diameter (inches)		Resistance at 20°C (68°F) (ohms/1000 ft) {max}	Diameter (inches) (min-max)	Weight (lbs/1000 ft)		Wrap 1		Wrap 2	
			(min)	(max)			(nom) 2/	(max)	Tape Code 3/	Over- lap(%) (min)	Tape Code 3/	Over- lap(%) (min)
M81381/21-26-*	26	19 x 38	.018	.021	41.3	.030-.034	1.2	1.3	.1/1/.1	50	.1/1/.1	50
M81381/21-24-*	24	19 x 36	.023	.026	26.2	.034-.038	1.9	2.0				
M81381/21-22-*	22	19 x 34	.029	.033	16.2	.041-.045	2.9	3.0				
M81381/21-20-*	20	19 x 32	.037	.041	9.88	.048-.053	4.2	4.4				
M81381/21-18-*	18	19 x 30	.046	.051	6.23	.058-.063	6.4	6.6				
M81381/21-16-*	16	19 x 29	.052	.058	4.81	.064-.069	8.2	8.4				
M81381/21-14-*	14	19 x 27	.065	.073	3.06	.077-.083	12.5	12.8				
M81381/21-12-*	12	37 x 28	.084	.090	2.02	.097-.102	20.4	20.7				
M81381/21-10-*	10	37 x 26	.106	.114	1.26	.120-.125	32.0	32.4				

1/ Part Number: The asterisks in the part number column, Tables I and II, shall be replaced by color code designators in accordance with MIL-STD-881, except that opaque dark yellow as defined in MIL-W-81381 shall be designated by the letter "N" and unpigmented polyimide resin coating shall be designated by the letter "C". Examples: Size 20, opaque dark yellow - M81381/21-20-N; same with orange stripe - M81381/21-20-N3.

2/ Nominal values are for information only. Nominal values are not requirements.

3/ Tape Code: .1/1/.1 0.1 mil FEP fluorocarbon resin/1 mil polyimide film/0.1 mil FEP fluorocarbon resin

FEP = Fluorinated Ethylene Propylene

Ⓐ denotes changes.

TABLE II. *Performance details.*

Part Number	Durability Test Load for		Abrasion Resistance				Bend Testing					
	Color Markings (grams)	Insulation Coatings (lbs)	Weight Support Bracket	Weight (lbs)	Tension Load (lbs)	Resistance (inches of tape) (min)	Mandrel diameter (inches) ( $\pm 3\%$ )				Test Load (lbs) ( $\pm 3\%$ )	
							Life Cycle (Oven & bend tests) $\frac{1}{2}$	Cold Bend Test	Wrap Test	Wrinkle Test	Life Cycle (Oven & bend tests) $\frac{1}{2}$	Cold Bend Test
M81381/21-26--	75	.50	A	.125	1.0	24	.250	.250	.125	.125	.50	
M81381/21-24--	75	.75	A	.125	1.0	24	.250	.250	.125	.125	.50	
M81381/21-22--	100	1.00	A	.125	1.0	24	.250	.250	.125	.156	.75	
M81381/21-20--	100	1.00	A	.125	1.0	24	.250	.250	.125	.188	.75	
M81381/21-18--	150	1.00	A	.125	1.0	24	.375	.375	.250	.250	1.00	
M81381/21-16--	150	1.00	A	.250	2.0	18	.375	.375	.250	.375	1.00	
M81381/21-14--	150	1.00	B	.250	2.0	18	.500	.375	.375	.500	2.00	
M81381/21-12--	150	1.00	B	.250	2.0	18	.750	.750	.375	.750	2.00	
M81381/21-10--	150	1.00	B	.250	2.0	18	.750	.750	.375	1.00	3.00	

$\frac{1}{2}$  Also for bend tests after immersion

#### WIRE RATINGS AND ADDITIONAL REQUIREMENTS

TEMPERATURE RATING: 150°C (302°F) max conductor temperature

VOLTAGE RATING: 600 volts (rms) at sea level

BLOCKING: Oven temperature, 200  $\pm$  2°C (392  $\pm$  3.6°F)

COLOR: As specified in contract or order in accordance with MIL-W-81381

#### A) CONDUCTOR STRAND ADHESION: Sizes 26 through 14 (Qualification and quality conformance requirement):

Conductors taken from wire in "as received" condition shall exhibit a count of 13 minimum when examined for conductor strand adhesion by the procedure described on page 3 of this specification sheet. In quality conformance inspection, conductor strand adhesion shall be a Group II characteristic, one specimen to be examined from each sample unit.

Sizes 12 and 10 (Qualification requirement only): Conductors taken from wire in "as received" condition, when examined by the qualifying activity, shall show a total count of unbonded single strands and metallic-bonded pairs or groups of strands which shall be not less than 70% of the total number of strands in the conductor.

FLAMMABILITY: 3 sec (max) after-flame

3.0 inches (max) flame travel

No flaming of tissue paper

HUMIDITY RESISTANCE: 5 megohms-1000 ft. min insulation resistance after humidity exposure

IDENTIFICATION OF PRODUCT: Required for sizes 22 and larger

IDENTIFICATION, STRIPING, OR BANDING DURABILITY: 125 cycles (250 strokes); see Table II for test load

IMPULSE DIELECTRIC TEST: 100% test; impulse voltage as specified in MIL-W-81381

INSULATION RESISTANCE: 2500 megohms-1000 ft (min)

LAMINATION SEALING: Oven temperature, 230  $\pm$  2°C (446  $\pm$  3.6°F)

LIFE CYCLE: Oven temperature, 230  $\pm$  2°C (446  $\pm$  3.6°F) for 500 hours (Darkening of the tin coating of the conductor due to normal air oxidation shall not be cause for rejection in this test.)

MINIMUM WALL THICKNESS: 5.0 mils

POLYIMIDE CURE TEST: Applicable

PROPELLANT RESISTANCE: Test not required

RESIN COATING DURABILITY: 250 cycles (500 strokes); see Table II for test load

SHRINKAGE: 0.031 inch (max) at 230  $\pm$  2°C (446  $\pm$  3.6°F)

SURFACE RESISTANCE: 5 megohms-inches (min), initial and final readings

THERMAL SHOCK: Oven temperature, 150  $\pm$  2°C (302  $\pm$  3.6°F) Change in measurement, 0.031 inch (max)

WET DIELECTRIC TEST: 2500 volts (rms)

WRINKLE TEST: No wrinkles shall be visible in the insulation at 3X magnification (3 diameters) after bending the wire one full turn around the mandrel specified in Table II. (The wire may be examined on the mandrel or after removal of the mandrel leaving the coil intact.) This test shall be included in the MIL-W-81381 quality conformance inspection as a Group II characteristic, one specimen to be tested from each sample unit.

Intended use note: The wire of this specification sheet is intended for hookup applications in electronic chassis. It is also intended for use in bundles under a protective jacket for interconnecting applications; e.g., in airframes.

Caution: This wire should not be subjected to physical contact with missile propellants.

**(A) Examination for Conductor Strand Adhesion (19-strand Conductor)**

The specimen shall be a six inch length of finished wire in initial or "as received" condition. With an insulation-stripping tool, initiate a stripping action two inches from one end of the specimen and, without kinking or otherwise damaging the conductor, move the insulation slug endwise until approximately 3/4 inch of the conductor is exposed. Remove the specimen from the stripping tool and proceed as follows for unidirectional or "true concentric" lay conductor as applicable.

**A. For unidirectional lay-**

- (a) Grip the insulation with the fingers at both ends of the exposed portion of the conductor and rotate one end of the specimen so as to untwist the exposed strands and make them parallel with the conductor axis. The use of rubber pads or similar holding aids is permitted.
- (b) Retain the grip position used to untwist the strands and carefully push the ends of the exposed portion of the conductor toward each other in the conductor axis, causing the strands to spread apart in a "bird cage" effect.
- (c) Gently probe unseparated strands with a fine needle or thin blade to determine whether they are fused together by metallic bonding or simply lying side by side. Metallic-bonded pairs or groups of strands which cannot be separated along the whole "bird cage" length, without forcing the needle or blade between the strands, shall each be counted as one in step (d).
- (d) Count the number of unbonded single strands plus the number of metallic-bonded pairs or groups of strands in the conductor.

**B. For "true concentric" lay-**

- (a) Perform step (a) as for unidirectional lay, but use only the rotation needed to untwist the 12-strand outer layer.
- (b) Perform step (b) as for unidirectional lay, using the pressure needed to "bird cage" the outer layer.
- (c), (d) On the "bird caged" outer layer, perform steps (c) and (d) as for unidirectional lay.
- (e) Using a suitable tool, snip through each unbonded single strand and each bonded pair or group of strands of the outer layer approximately in the center of the "bird cage" and fold the snipped ends back toward the respective ends of the specimen. Do not cut the 7-strand core of the conductor.
- (f) Repeat steps (a), (b), (c), and (d) with the 7-strand core.
- (g) Add the count of unbonded single strands and bonded pairs or groups of strands in the core to the count previously derived from the outer layer. This total is the count applicable to the entire 19-strand conductor.

- C. Interpretation of results-For a 19-strand conductor, whether unidirectional or "true concentric" lay, the count of unbonded single strands plus the count of metallic-bonded pairs or groups of strands in the conductor shall be not less than the minimum total count specified in the applicable specification or specification sheet.

Preparing activity:  
Navy - AS  
(Project No. 6145-N281)

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

☐ VENDOR

☐ USER

☐ MANUFACTURER

☐ OTHER (Specify): \_\_\_\_\_

b. ADDRESS (Street, City, State, ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) – Optional

b. WORK TELEPHONE NUMBER (Include Area Code) – Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) – Optional

8. DATE OF SUBMISSION (YYMMDD)

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